

Claims

1. A machine for the industrial peeling of citrus fruits, characterized in that it comprises:

a feeder, which is actuated by an intermittent mechanism that moves the feeder in synchronism with other devices of the machine;

a manipulator, including pliers used to grasp and to pick up the fruit from the feeder, and to displace it towards a predetermined position;

a rotatable turntable, having a horizontal axis and four work stations, wherein in the first station the fruit is clamped and retained, and thereafter it is rotated successively towards the following stations;

four mechanisms, individually associated to a respective station, and having each a specific function, that is, to clamp and retain the fruit, to detect and assign a numeric value to the fruit diameter and to the thickness of the peel plus the mesocarp, to peel the fruit, to cut the ends of the fruit at the seizing portions and to separately discharge the peel and the peeled fruit;

a mechanism that brings about the intermittent motion, and various connections between the mechanisms.

2. A machine according to claim 1, wherein said feeder includes chain means of a known kind, or any equivalent known means, that move horizontally and intermittently with a fixed pitch and in synchronism with the other devices of the machine.

3. A machine according to claim 2, wherein cups or caps are attached to the chain means at mutual distances corresponding to the advancement pitch of the chain means, said cups or caps being sized and configured in such a way as to be able to receive and preserve the orientation of the fruit therein, after it has been manually

put on the cap with its symmetry axis arranged horizontally and perpendicularly to the chain means advancement direction.

4. A machine according to claim 1, wherein said manipulator includes:

a) pliers configured and dimensioned for picking up and grasp the fruit from said feeder;

b) a plurality of levers and connecting rods that are appropriately sized and connected to each other so that, through the intervention of a cam or of a known linear actuator, the fruit is displaced from the position where it is picked up, towards a position corresponding to the prolongation of the operative axis of the first work station of said four-stations turntable.

5. A machine according to claim 4, wherein said pliers of the manipulator are preferably actuated by means of a pneumatic actuator.

6. A machine according to claim 4, wherein the manipulator is apt to displace the fruit so that the symmetry axis of the latter is arranged horizontally and concentrically to the prolongation of the operative axis of the first station comprised in said four-stations turntable.

7. A machine according to claim 4, wherein said cam or said linear actuator actuates the manipulator in synchronism with the movement of the feeder and of the four-stations turntable.

8. A machine according to claim 1, wherein said rotatable turntable, with horizontal axis and four stations, is orthogonal to the advancement direction of said feeder and is synchronized with respect to the intermittent motion of the feeder and manipulator, and moreover it includes the following features:

- a) a central motorized shaft (27) which is intermittently moved;*
- b) two circular plates (26/a, 26/b) integral with said shaft and spaced apart from each other;*
- c) four spindle pairs mounted on the circular plates, wherein four spindles are arranged on a first circular plate and on the same circumference, at 90° to each other, and the other four spindles are arranged on the second circular plate, with their axes parallel and concentric to the axes of the former four spindles;*
- d) four rods (37), located adjacent to each spindle pair, and whose axes are parallel to the spindle axes;*
- e) four rocker arms (39) connecting an end of a respective rod with a small shaft (29) that supports each spindle of a circular plate (26/a);*
- f) four brackets (36) connecting the other end of the rods (37) to each small shaft (33) that supports each spindle (31) arranged on the other small plate (26/b);*
- g) four locking devices (43), each of which is associated to a rod and may be independently operated to prevent or to permit axial sliding of the rods, so that, by pushing in the axial direction on the brackets which connect a respective rod to a small shaft (33) that supports a spindle, both spindles forming a pair of spindles come closer to each other or move away in a self-centering manner with respect to a point that may be considered the reference point, and wherein said reference point associated to each spindle pair is located equidistantly from the surfaces of the circular plates, due to the fact that said small shafts (29, 33) that support the spindles may axially slide on their supports in the same way as the rods (37) can do.*

9. A machine according to claim 8, wherein the small heads of the eight spindles are idly mounted on the respective small shafts that support them.

10. A machine according to claim 8, wherein the four spindles (31) mounted on one

circular plate (26/b), carry an integral toothed pinion (35) on the opposite side with respect to the circular plate, and this toothed pinion is associated to a motorized toothed wheel in the third and fourth stations of the turntable, in such a way that the spindles are driven in the latter stations and spin the fruit which is clamped between the spindles of a spindle pair.

11. A machine according to claim 8, wherein the eight spindles carry frontal thorns (42) apt to stick in the peel of the fruit when they are pushed towards the fruit.

12. A machine according to claims 1 and 8, wherein in the first work station of the turntable the fruit is clamped between two spindles (28, 31).

13. A machine according to claim 12, wherein a linear actuator (41) supported by the machine structure, or basement, is apt to exert a pressure on the bracket (36) that connects the rod (37) to the small shafts (29, 33) that sustain the spindles (28, 31), whereby the latter may clamp the fruit, and when the locking device (43) of the rod (37) has been actuated, the actuator (41) that has caused the clamping of the fruit between the spindles (28, 31) may retract while the fruit remains clamped.

14. A machine according to claims 1 and 8, wherein a device of a known kind, which is located in the second station of the turntable, and which is suited to measure, or at least to detect, at least the fruit diameter, and to transmit or transfer these data to the successive station, allows to control the peeling mechanism arranged in the third station of the turntable.

15. A machine according to claim 14, wherein, in order to make sure that in the following station the peeling mill will remove only the peel together with the underlying mesocarp,

a) an electronic feeler or tracing point (4) of a known kind, which feels and follows the outer surface of the fruit, sends a proportional signal to an encoder, and the latter, by means of a step motor, continuously adjusts the tilt of a mill carrying arm, thereby insuring a regular peeling, according to the measurement of the layer to be removed, which was previously estimated on the basis of fruits sampling, and according to the resulting regulation of the projection to be assigned to the mill with respect to the feeler; or

b) a laser feeler or an ultrasound feeler (4) of a known kind is used, which besides measuring the dimension of the fruit, also continuously determines the value of the thickness of the peel and mesocarp.

16. A machine according to claims 1 and 8, wherein at the third work station and on the machine's fixed structure or basement, there is provided a milling device which is known per se, and which is positioned in such a way as to be able to carry out fruit peeling by virtue of the following:

- the fruit is transferred to the third work station;*
- the peeling device has independent driving means of said mill;*
- the latter receives from the preceding station a proportional signal defining the position to be assumed by the mill with respect to the fruit's geometric center;*
- the peeling device begins to operate after a signal, synchronized with the other stations, has been received by it;*
- the fruit is spun.*

17. A machine according to claims 1 and 8, wherein at the fourth work station, and on the machine's structure or basement, there is provided, at an appropriate position, a mechanism including a rod (54) and a rocker arm (55) similar to that used to clamp the fruits on the turntable (3), said device centering in an automatic way two cutting blades (6) in accordance to the distance existing between the

spindles (28, 31) that retain the fruit (11).

18. A machine according to claim 17, wherein:

- the fruit is spun;*
- the two cutting blades (6) are made to approach and to contact the fruit by the action of a cam;*
- the two cutting blades perform the fruit end-cutting operation simultaneously, in proximity of the spindles (28, 31) used to retain and to spin the fruit;*
- the cutting leads to the removal of calottes (48,49) which have not been peeled.*

19. A machine according to claims 17 and 18, wherein, after the end-cutting, the blades return to their rest position, the rod locking device (43) unlocks, and the peeled fruit cut at its ends can fall onto an inclined plane (58) that guides it to a container, or onto a conveyor belt.

20. A machine according to claims 17, 18 and 19, wherein to make sure that the removed calottes do not remain on the thorns (42) of the spindles, there is provided a linear actuator (60) that acts on knockouts (59) received inside said small shafts (29,33) which support the spindles (28, 31), said knockouts consisting of simple axially slidable round bars.

21. A machine according to claim 1, wherein said intermittent mechanism may be realized in any known configuration, for instance as a Maltese cross.

22. A machine according to claim 1, wherein said connections between the various mechanisms that form the machine, are also of a known kind, and are selected among those insuring the preservation of the timings, e.g.

- chain transmissions;*

- *toothed wheel transmissions;*
- *cardan shaft transmissions;*

and wherein the machine could be realized so as to comprise a single module, as described and illustrated above, or so as to include several modules, and in the latter case with a single feeder or with a feeder for each module.